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CONTRIBUTIONS TO THE FLORA OF NOVA SCOTIA VIII. DISTRIBUTION OF ARCTIC-ALPINE AND BOREAL DISJUNCTS¹

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Botanical exploration in Nova Scotia during the past 17 years has revealed a large number of disjunct species of northern affinities. These may be classified as either Arctic-alpine or Boreal disjuncts. Scoggan (1950) classifies arctic species as those whose northern ranges extend beyond the tree line, "including coastal Labrador north of Hamilton Inlet;" both Scoggan's and Fernald's publications (1950) have been consulted in drawing up the present list of species. The boreal species are those whose geographical distribution is confined, generally, to the Northern Conifer Forest. A third group of Nova Scotia disjuncts, containing but three species, may be termed Gulf endemics, i.e., those species found only in isolated localities around the Gulf of St. Lawrence.

Evidence has existed for at least 80 years that such disjuncts in Nova Scotia have two centers of distribution. Lawson (1884) found *Saxifraga aizoon* Jacq. var. *neogaea* Butters growing in great abundance on the high basalt cliffs of Cape Blomidon, Kings Co. In his catalogue of the

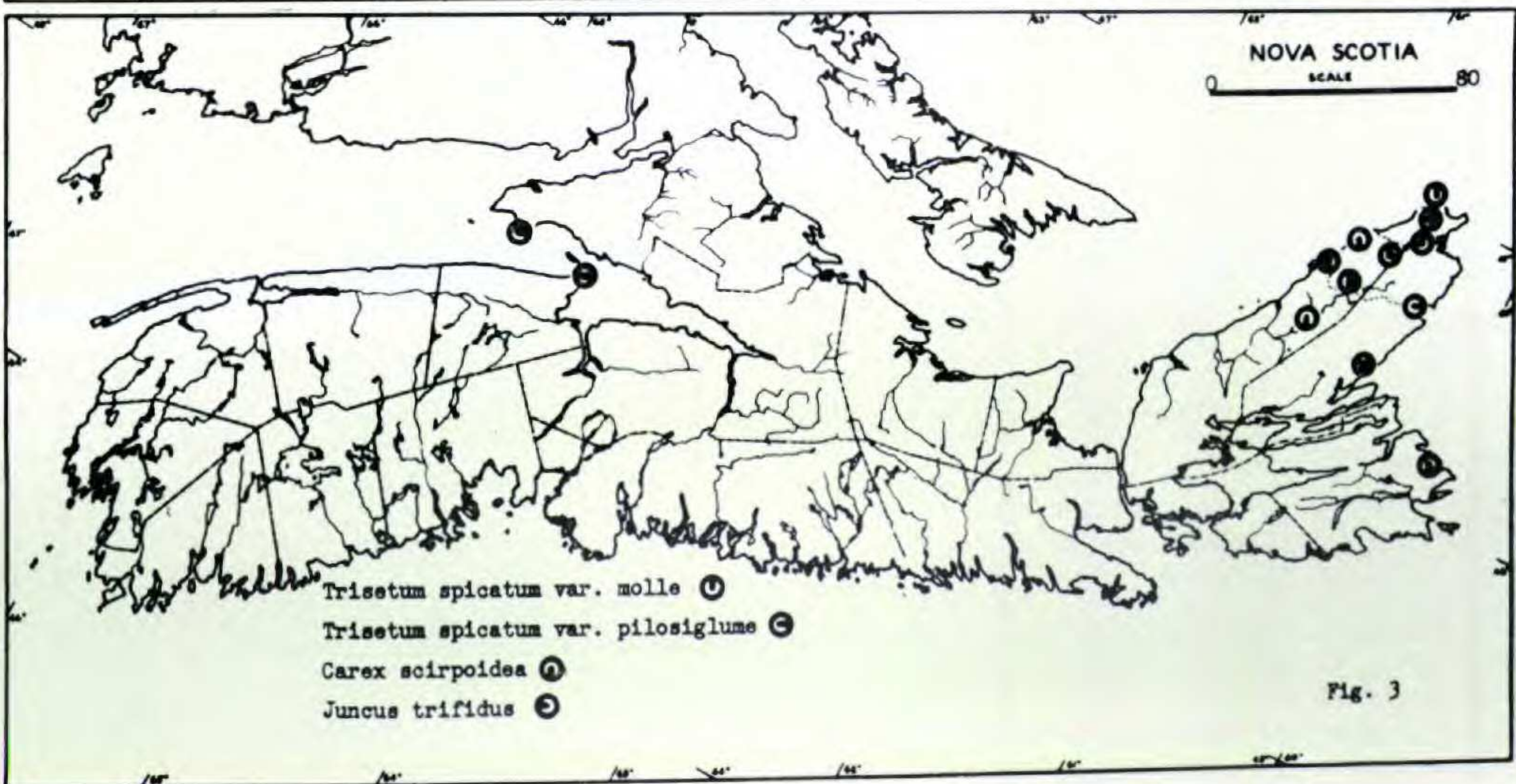
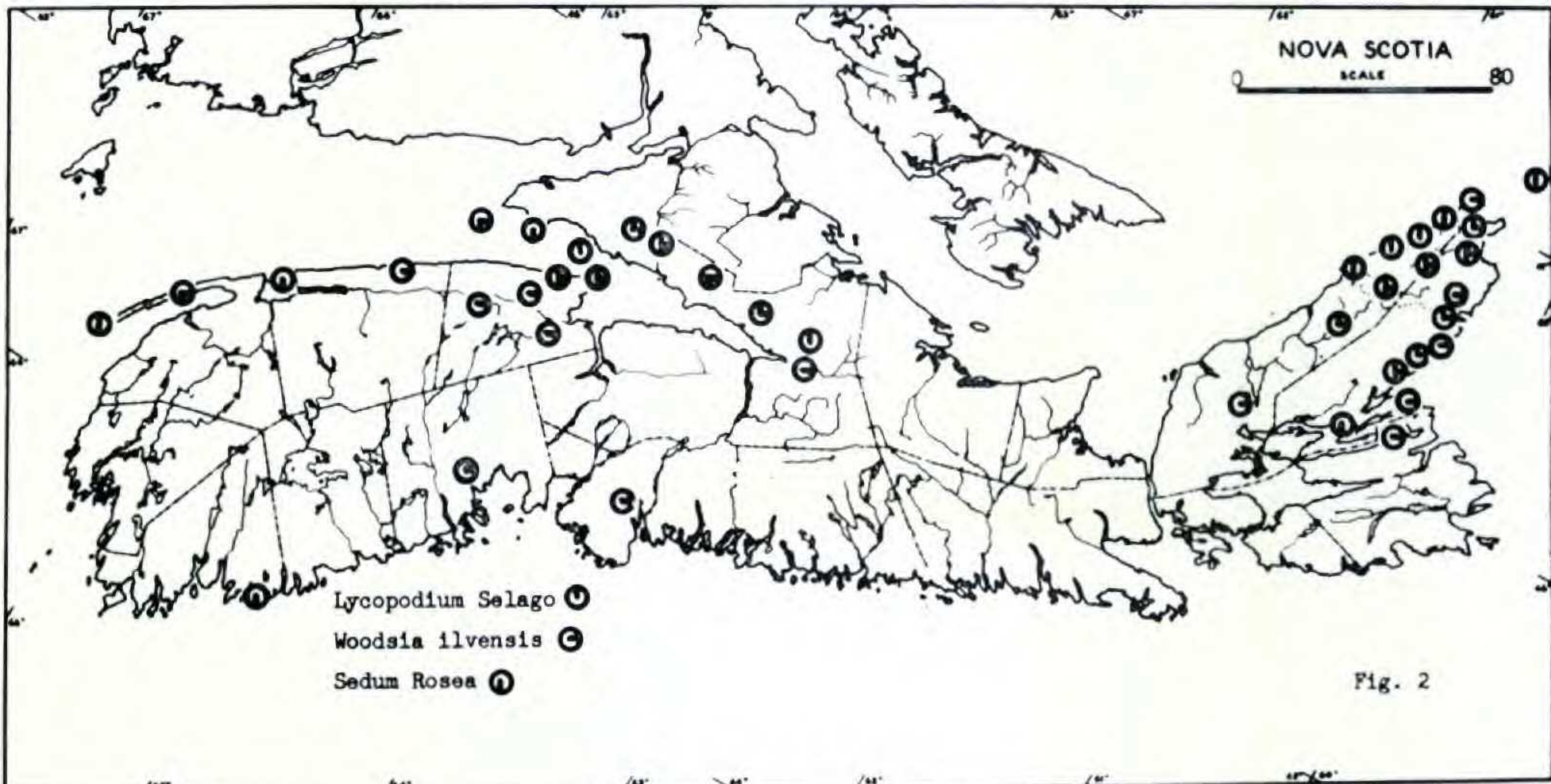
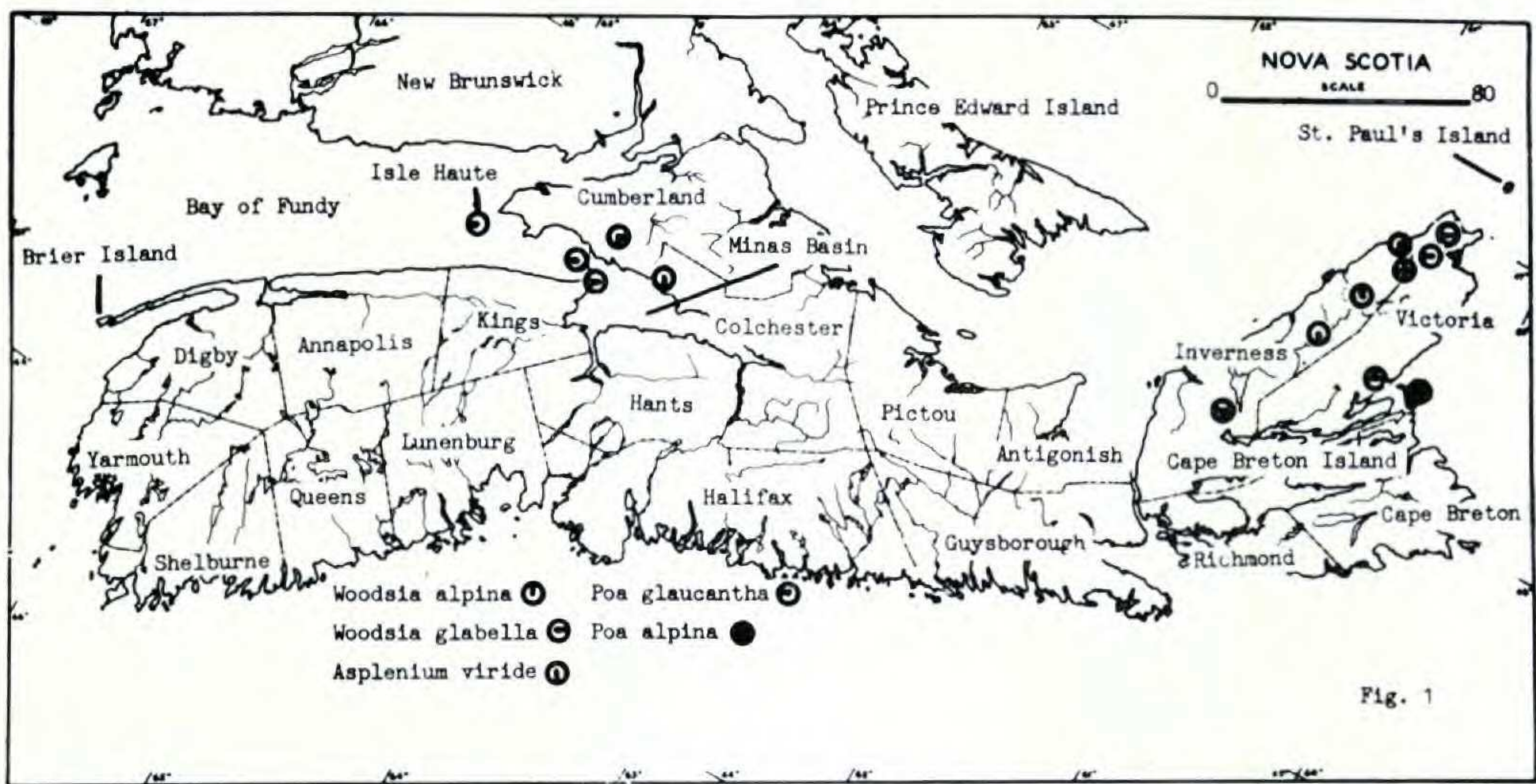
¹This study was supported in part by the Nova Scotia Research Foundation. Acknowledgement is due also to the many members of the Forest Ecology field crews who, over the years, made most of the collections utilized in this study and to Dr. H. Harries of Mount Allison University for permission to cite his collection of *Luzula spicata*.

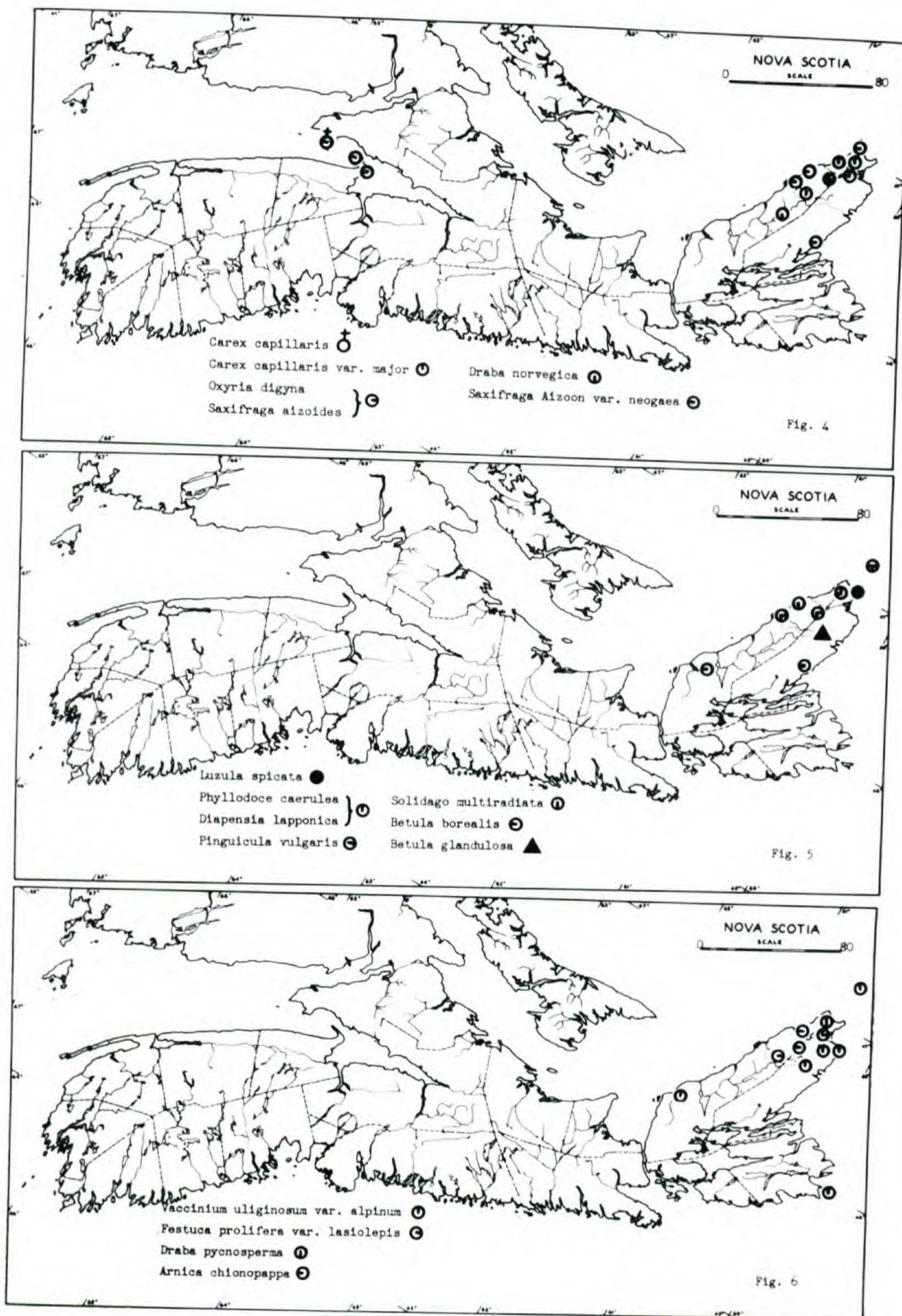
Nova Scotian flora Lindsay (1887) listed *Draba norvegica* Gunn. as being found in rock crevices, Big Intervale, Inverness Co. The many new finds of recent years, chiefly made by the junior author and his student field crews from Acadia University, have substantiated these early suggestions of bicentric distribution.

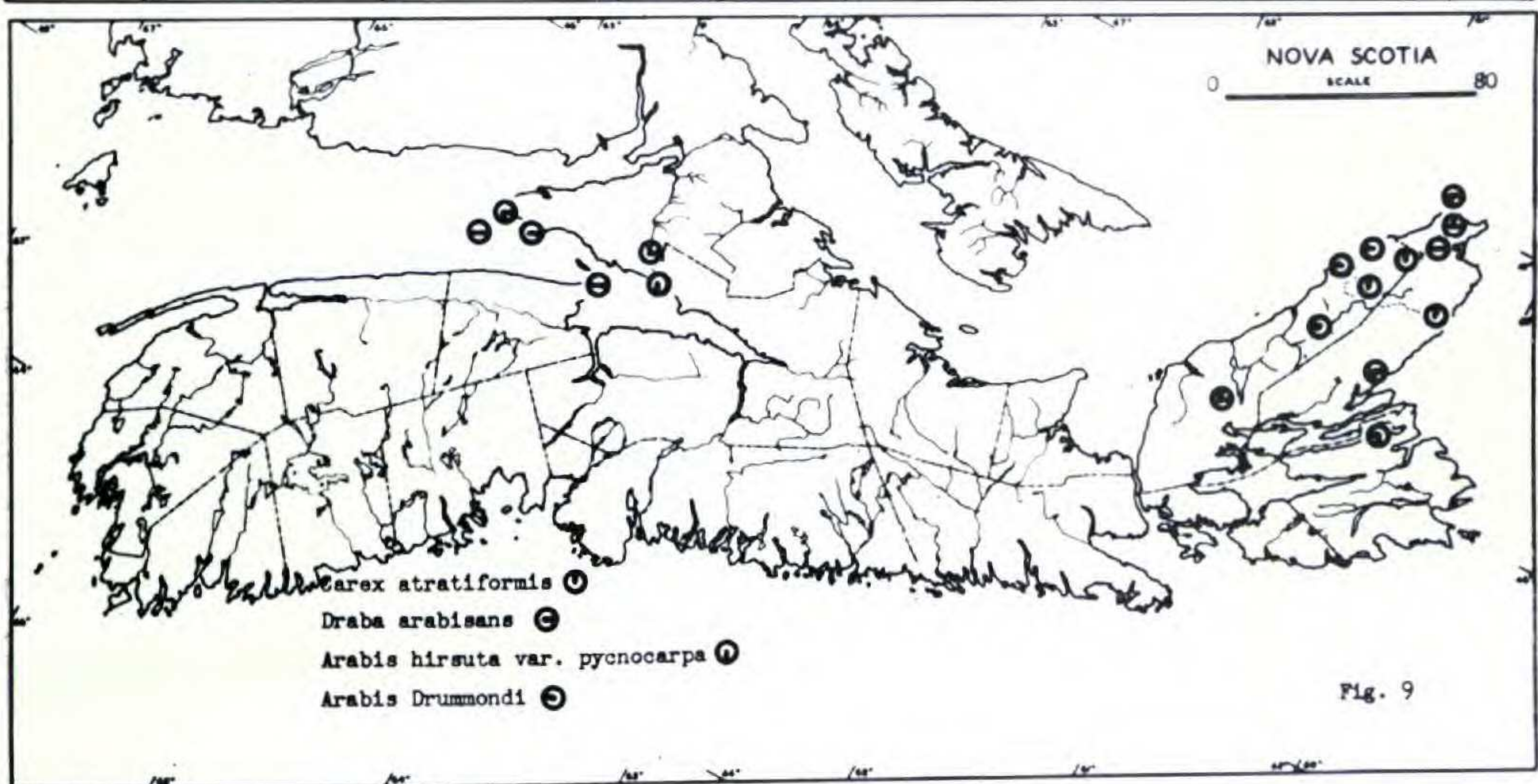
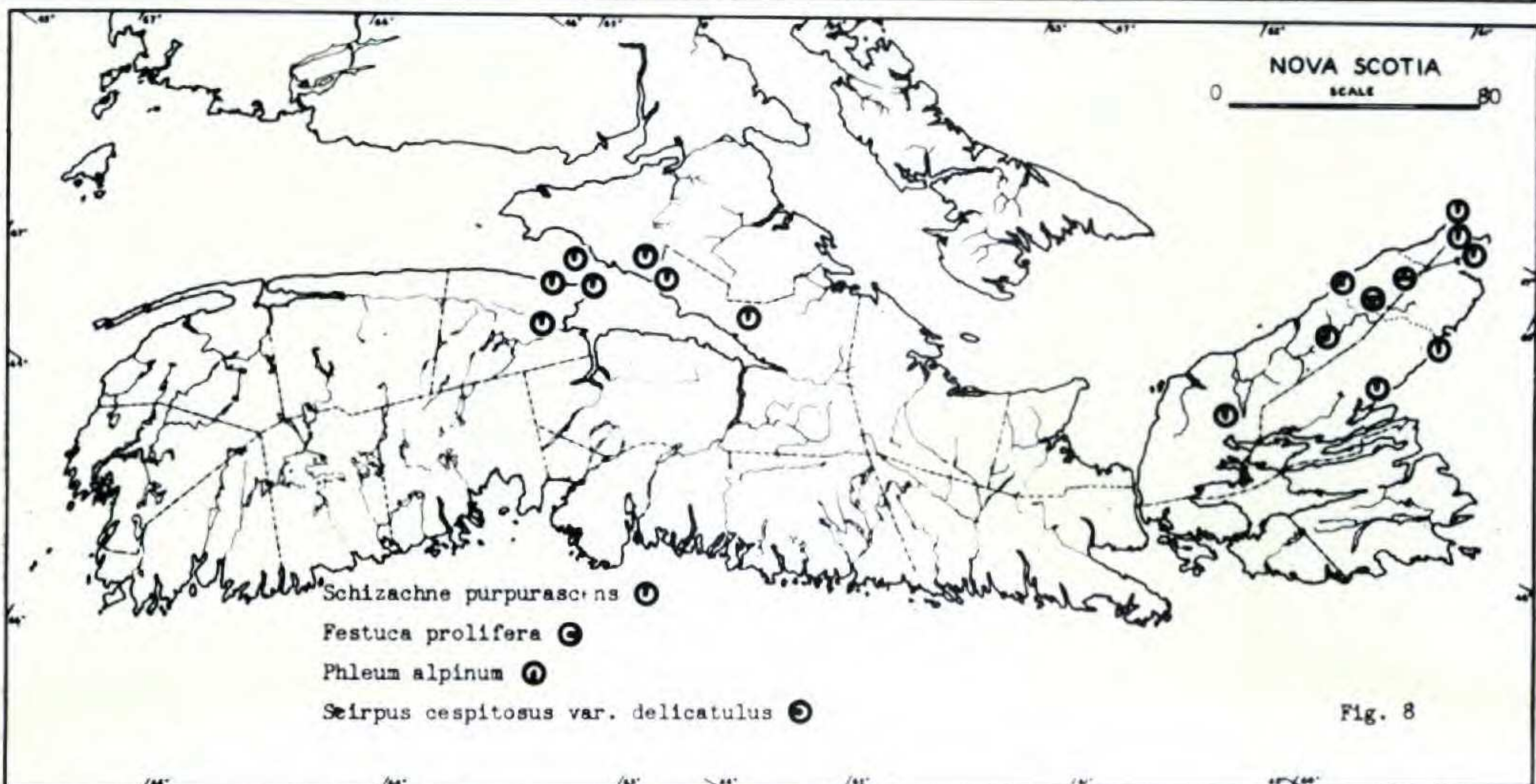
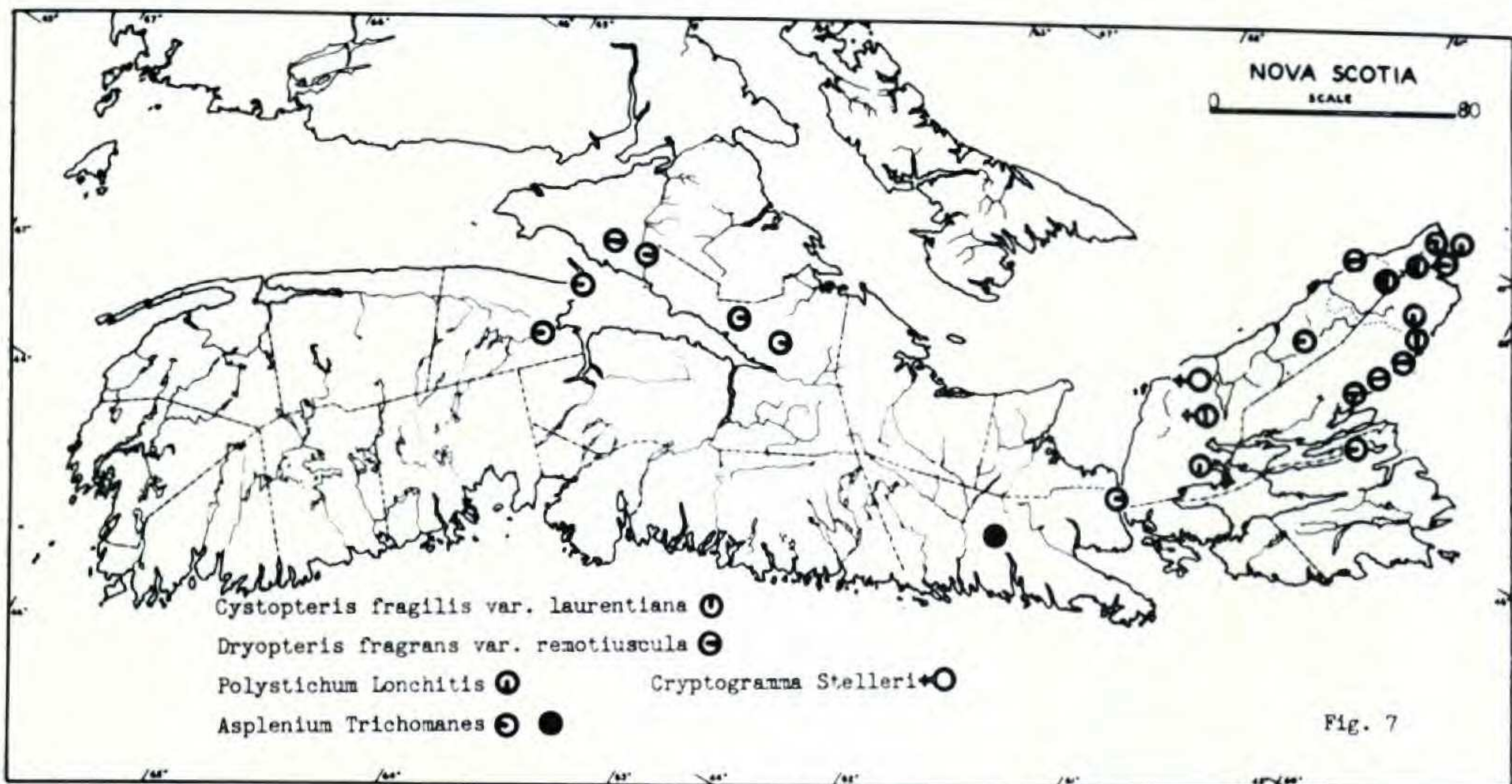
Erskine (1951) recorded *Asplenium viride* Huds. for two new stations, one in Cumberland Co. near the Minas Basin, the other in Inverness Co. in northern Cape Breton. The Nova Scotia distribution for this species is typical of that of many Arctic-alpine and Boreal disjuncts in that it occurs in the Cobequid Hills near Minas Basin and again in the highlands of northern Cape Breton Island. In the region that borders on Minas Basin such species are found on exposed rocky sites of Cumberland, Colchester and Kings counties, less frequently in Hants county and along the Bay of Fundy shoreline into Annapolis and Digby counties. On Cape Breton Island they occupy suitable niches in Inverness and Victoria counties (usually along moist, steep-walled river gorges), much less frequently in Cape Breton and Richmond counties. The region between these two centers, about 170 miles in a direct line, is, apparently, devoid of these species.

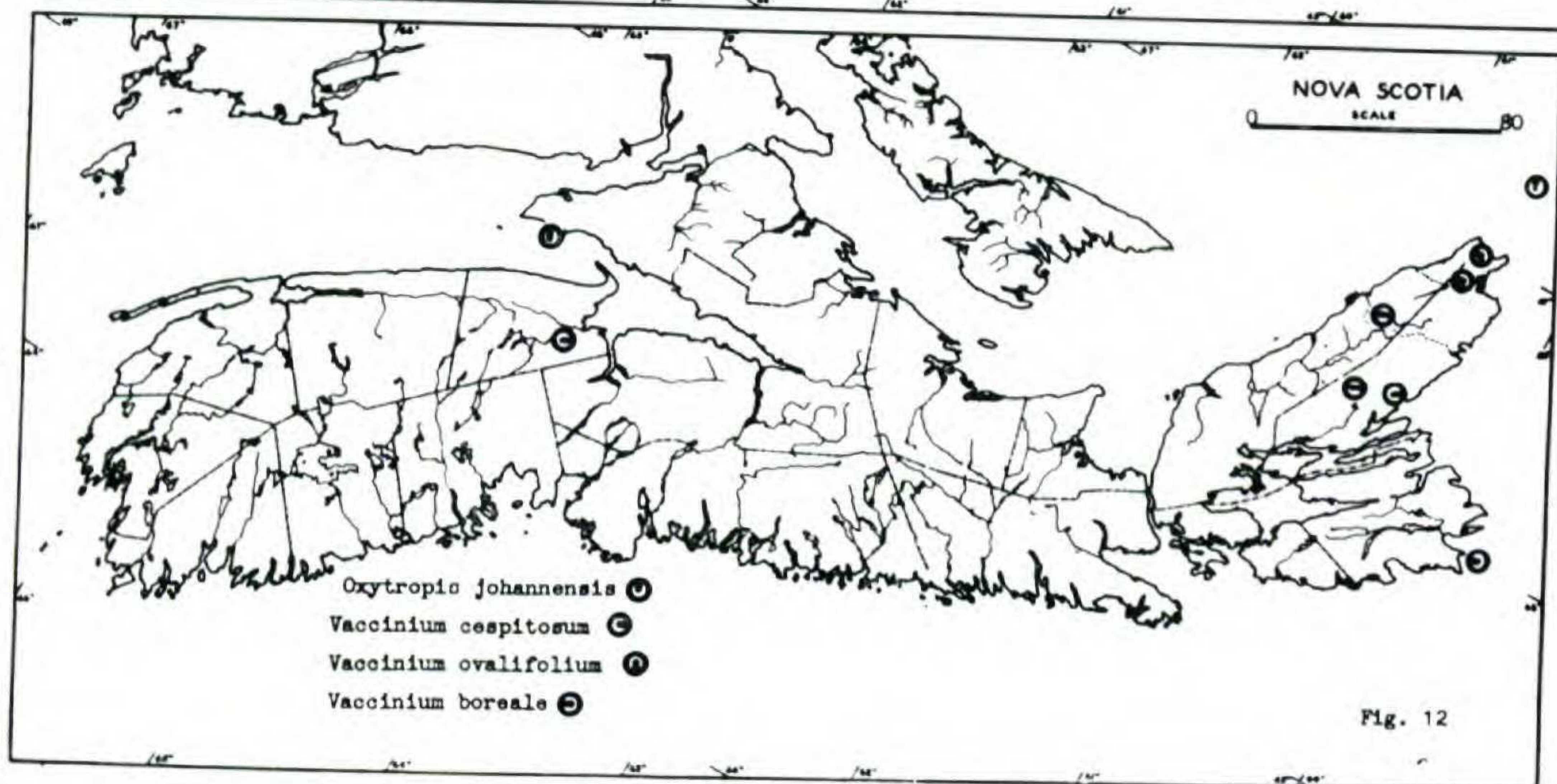
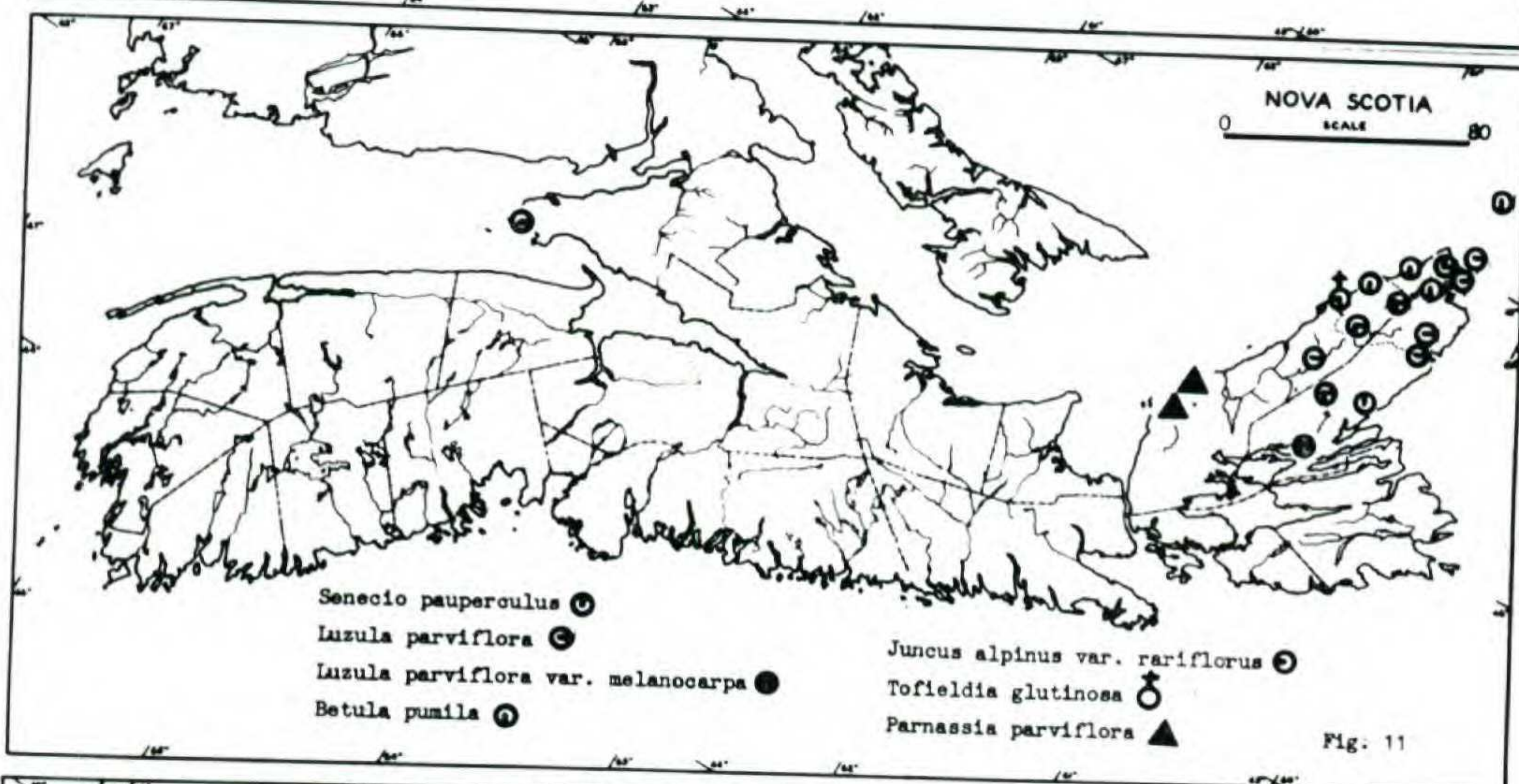
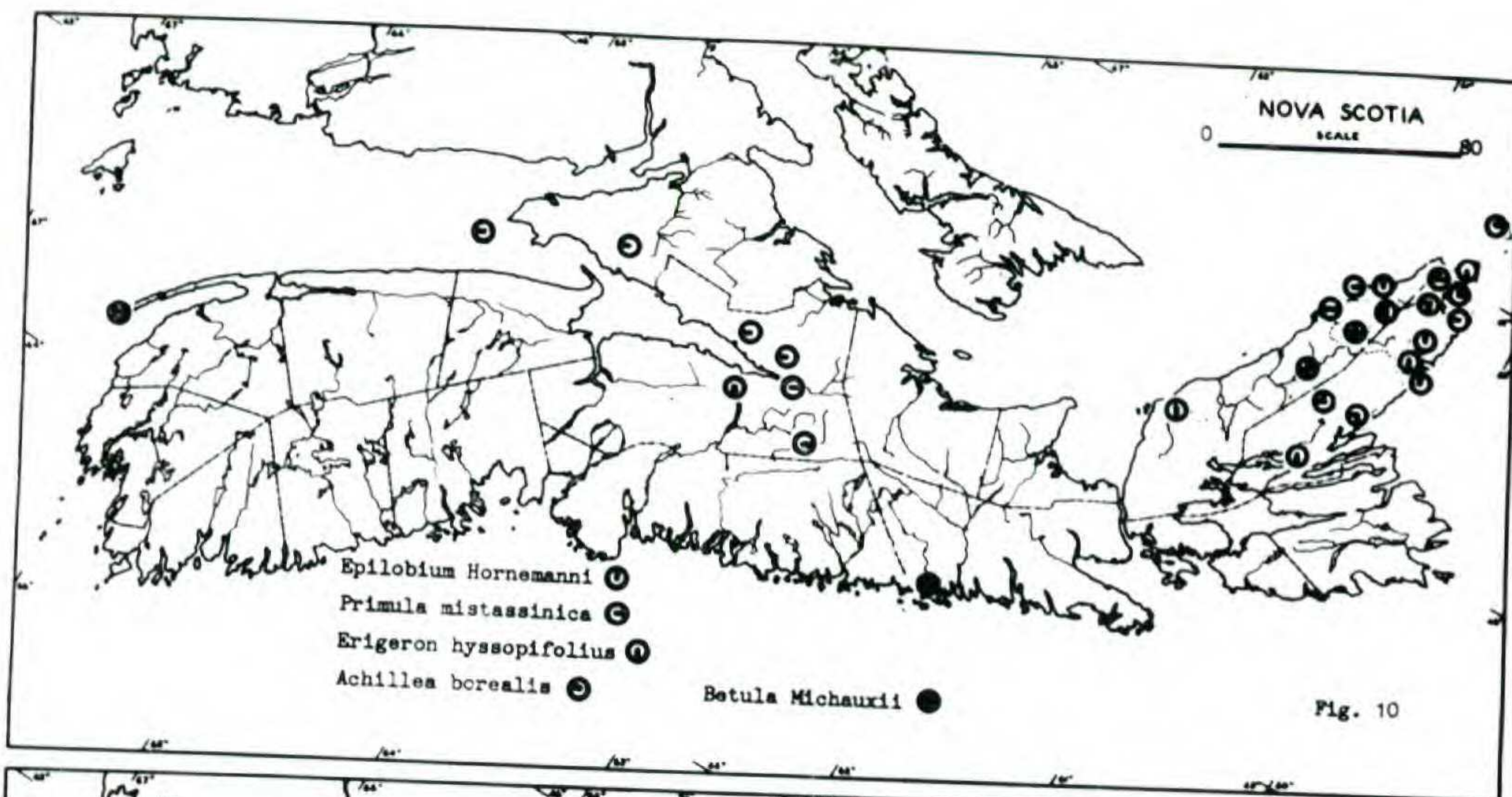
Smith and Schofield (1952) added to the growing list of Arctic-montane species recorded for the province. To the inventory of Nova Scotian plants they added *Oxyria digyna* (L.) Hill, *Saxifraga aizoides* L. and others, all found in northern Cape Breton. The very local distribution of these disjuncts was noted by Smith and Erskine (1954); almost every river valley explored in northern Cape Breton harbored a new species, but, in each case, the stations discovered were of very limited size.

Further evidence supporting the concept of two centers of occurrence was provided by Schofield (1955) in his explorations in Cumberland county. He showed that many of the disjunct Arctic-alpine and Boreal species found in rugged habitats of northern Cape Breton are also present in Cumberland county and the near-by Cape Blomidon









region of Kings county where they occupy exposed headlands and such similar sites.

The accompanying distribution maps (Figs. 1-12) show the bicentric distribution quite clearly. Each symbol, in most cases, represents several small stations, each of which is separated from the others of its group by distances ranging from a few hundred yards up to five miles; for example, a number of stations found along the cliffs of a river valley are represented here by a single distribution dot.

The counties of Nova Scotia plus other pertinent geographical features are shown in Fig. 1 along with the distribution pattern for five Arctic-alpine species. Of these five species all are found in the northern Cape Breton region (henceforth NCB) whereas three are known from the Minas Basin-Bay of Fundy region (henceforth MB-BF). None are found outside these two areas. When the overall Arctic-alpine picture is assessed one sees that of the 26 species dealt with in this survey (see Table 1, part A) 25 are found in NCB, nine in MB-BF and only 2 beyond these two centers. The two found outside these areas (as well as within them) are: *Woodsia ilvensis* (L.) R.Br., from Halifax and Lunenburg counties and *Sedum Rosea* (L.) Scop., which has been collected from Louis Head, Shelburne county. These two widespread Arctic-alpine species plus a third, of perhaps even wider distribution, *Lycopodium Selago* L., are shown in Fig. 2.

Of these 26 species only one, *Carex capillaris* L., has been found in MB-BF but not in NCB.

Most of these Arctic-alpines inhabit river gorge cliffs or exposed outcroppings and headlands but three are plants of the high barrens and bogs: *Betula glandulosa* Michx., *B. borealis* Spach and *Vaccinium uliginosum* L. var. *alpinum* Bigel.

An examination of the distributions of the 32 species classified as Boreal disjuncts and Gulf endemics (Figs. 7-12 and Table 1, part B) reveals that 31 of these are found in NCB, 14 in MB-BF and two only occur in other regions as well. *Asplenium Trichomanes* L. has been reported from

Guysborough Co. by Roland (1947) but since the exact location of the station is not known to the present authors a solid black dot has been placed in the centre of the county (Fig. 7). *Betula Michauxii* Spach grows in Guysborough Co. and on Brier Island, Digby Co. but not in NCB (Fig. 10). Brier Island represents the southwestern extremity of the elevated section of land that lies between the Annap-

TABLE 1

Numbers of Arctic-alpine, Boreal disjunct and Gulf endemic stations in Nova Scotia (NCB — Northern Cape Breton, MB-BF — Minas Basin and Bay of Fundy)

A. Arctic-alpine

Species	NCB	MB-BF	others	total
<i>Lycopodium Selago</i> L.	18	9	—	27
<i>Woodsia ilvensis</i> (L.) R. Br.	19	17	5	41
<i>Woodsia alpina</i> (Bolton) S. F. Gray	5	—	—	5
<i>Woodsia glabella</i> R. Br.	6	1	—	7
<i>Asplenium viride</i> Huds.	6	2	—	8
<i>Poa alpina</i> L.	1	—	—	1
<i>Poa glaucantha</i> Gaudin	5	4	—	9
<i>Trisetum spicatum</i> (L.) Richter				
var. <i>molle</i> (Michx.) Beal	6	—	—	6
<i>Trisetum spicatum</i> (L.) Richter				
var. <i>pilosiglume</i> Fern.	7	3	—	10
<i>Carex scirpoidea</i> Michx.	8	—	—	8
<i>Carex capillaris</i> L.	—	1	—	1
<i>Carex capillaris</i> L. var. <i>major</i> Blytt	6	—	—	6
<i>Juncus trifidus</i> L.	3	—	—	3
<i>Luzula spicata</i> (L.) DC.	1	—	—	1
<i>Betula borealis</i> Spach	4	—	—	4
<i>Betula glandulosa</i> Michx.	1	—	—	1
<i>Oxyria digyna</i> (L.) Hill	1	—	—	1
<i>Draba norvegica</i> Gunn	2	—	—	2
<i>Sedum Rosea</i> (L.) Scop.	7	7	5	19
<i>Saxifraga aizoides</i> L.	1	—	—	1
<i>Saxifraga Aizoon</i> Jacq. var. <i>neogaea</i> Butters	6	3	—	9
<i>Phyllodoce caerulea</i> (L.) Bab.	1	—	—	1
<i>Vaccinium uliginosum</i> L. var. <i>alpinum</i> Bigel.	10	—	—	10
<i>Diapensia lapponica</i> L.	1	—	—	1
<i>Pinguicula vulgaris</i> L.	3	—	—	3
<i>Solidago multiradiata</i> Ait.	4	—	—	4
	25/26	9/26	2/26	

B. Boreal Disjuncts, Gulf Endemics(*).

Species	NCB	MB-BF	others	total
<i>Cystopteris fragilis</i> (L.) Bernh.	4	—	—	4
var. <i>laurentiana</i> Weath.	—	—	—	—
<i>Dryopteris fragrans</i> (L.) Schott	5	5	—	10
var. <i>remotiuscula</i> Komarov	13	—	—	13
<i>Polystichum Lonchitis</i> (L.) Roth	15	3	1	19
<i>Asplenium Trichomanes</i> L.	2	—	—	2
<i>Cryptogramma Stelleri</i> (Gmel.) Prantl	11	7	—	18
<i>Schizachne purpurascens</i> (Torr.) Swallen	3	—	—	3
<i>Festuca prolifera</i> (Piper) Fern.	2	—	—	2
<i>Festuca prolifera</i> (Piper) Fern.	3	—	—	3
var. <i>lasiolepsis</i> Fern.*	5	—	—	5
<i>Phleum alpinum</i> L.	10	1	—	11
<i>Scirpus cespitosus</i> L. var. <i>delicatulus</i> Fern.	1	—	—	1
<i>Carex atratiformis</i> Britt.	12	4	—	16
<i>Juncus alpinus</i> Vill. var. <i>rariflorus</i> Hartm.	1	—	—	1
<i>Luzula parviflora</i> (Ehrh.) Desv.	1	—	—	1
<i>Luzula parviflora</i> (Ehrh.) Desv.	1	—	—	1
var. <i>melanocarpa</i> (Michx.) Buchenau	8	—	—	8
<i>Tofieldia glutinosa</i> (Michx.) Pers.	—	1	1	2
<i>Betula pumila</i> L.	1	—	—	1
<i>Betula Michauxii</i> Spach	5	5	—	10
<i>Draba pycnosperma</i> Fern. & Knowlt.*	2	3	—	5
<i>Draba arabisans</i> Michx.	6	2	—	8
<i>Arabis hirsuta</i> (L.) Scop.	2	—	—	2
var. <i>pycnocarpa</i> (M. Hopkins) Rollins	1	1	—	2
<i>Arabis Drummondii</i> Gray	12	—	—	12
<i>Parnassia parviflora</i> DC.	3	1	—	4
<i>Oxytropis johannensis</i> Fern.	2	—	—	2
<i>Epilobium Hornemanni</i> Reichenb.	3	—	—	3
<i>Vaccinium cespitosum</i> Michx.	2	—	—	2
<i>Vaccinium ovalifolium</i> Sm.	3	—	—	3
<i>Vaccinium boreale</i> Hall & Aalders	7	2	—	9
<i>Primula mistassinica</i> Michx.	10	5	—	15
<i>Erigeron hyssopifolius</i> Michx.	11	4	—	15
<i>Achillea borealis</i> Bong.	2	—	—	2
<i>Arnica chionopappa</i> Fern.*	2	—	—	2
<i>Senecio pauperculus</i> Michx.	—	—	—	—
	31/32	14/32	2/32	
Grand totals	56/58	23/58	4/58	

olis Valley and the Bay of Fundy. This elevated area, known as North Mountain, is about 500 feet high at Cape Blomidon at the Minas Basin end but becomes lower to the southwest so that at Brier Island the land is low, flat and boggy.

Combining the Arctic-alpine and Boreal disjunct figures one sees that of the 58 species 56 have been collected in NCB but only 23 in MB-BF. This fact can be correlated with the greater number of suitable habitats in NCB, particularly damp, cool cliffs along the many river valleys and gorges. A following paper will present descriptions of these cliff-face stations, discussing the ecological implications.

The following collections, used in this study, have not been reported previously:

Poa alpina L. Cliff top, Ciboux Island, Victoria Co., *Smith et al.* 10958. First collection for province.

Luzula spicata (L.) DC. Headlands at 1000 feet near Bay St. Lawrence, Victoria Co., *H. Harries*, 804. First collection for province.

Pinguicula vulgaris L. Rare on moist ledges in sphagnum, cliff near mouth of Cheticamp River, Inverness Co., *D. H. Webster*, 626. Two plants in small crevices at river edge, Big Southwest Brook, Inverness Co., *Smith, Pick and Hounsell*, 22134. This species had previously been collected only from St. Paul's Island by *Perry* and *Roscoe*, 352, in 1929.

Arnica chionopappa Fern. The collection from cliff ledges, Big Southwest Brook, *Smith, et al.* 6503, represents a second station for the province.

The distribution maps were compiled from collections deposited in the Herbarium of Acadia University. Additional distributional information was obtained from Roland (1947).

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